

REMARKS

This invention relates to a method of decomposing a thermosetting resin, and to an apparatus and a heat control program for carrying out the method.

The rejections of Claims 1, 2, 4-6, 8-12, and 17 under 35 U.S.C. § 102(b) as anticipated by U.S. 3,954,681 (Castle), and of Claims 13-16 under 35 U.S.C. § 103(a) as unpatentable over Castle in view of U.S. 5,616,623 (Münzmay et al), are respectfully traversed.

As described in the specification under "Description of the Background," beginning at page 1, line 8, processes exist in the prior art for decomposing thermosetting resins such as urethane resins, but they have been problematical, such as the requirement of inordinate amounts of time. The present invention addresses these problems.

Castle discloses a method of **reclaiming** cured polyurethane elastomers to form partially devulcanized elastomeric end products (column 1, lines 9-13; emphasis added.) Castle is thus irrelevant, since Castle is not drawn to decomposing cured polyurethane elastomers, but rather to breaking cross-linkages thereof without adversely affecting the molecular composition of the urethanes (column 1, lines 58-62).

Münzmay et al does not remedy the above-discussed deficiencies of Castle. Münzmay et al has been relied on for a disclosure of compounds, such as various ethanol amines and other amino alcohols, that react with polyurethanes for purposes of decomposing them. Münzmay et al is specifically concerned with compounds that contain at least two isocyanate-reactive hydrogen atoms. But one skilled in the art looking to improve or otherwise modify the reclamation method of Castle would not look to prior art drawn to decomposition.

The above, in and of itself, is sufficient to distinguish Castle, and Castle combined with Münzmay et al. In addition, comparative data of record demonstrates the importance of both T0 and t of the present claims.

The method steps of Claim 1 herein, after reciting the preheating step, i.e., preheating the thermosetting resin up to a preheating temperature T0, are:

kneading the pre-heated thermosetting resin together with a decomposer, and concurrently heating a mixture comprising the thermosetting resin and the decomposer up to a kneading temperature T1, thereby allowing a reaction to take place between the decomposer and the thermosetting resin to obtain a kneaded matter wherein the decomposer becomes consumed; and

heating said kneaded matter to a maximum temperature T2 to decompose the thermosetting resin; wherein:

said pre-heating temperature T0 is not higher than the boiling temperature of said decomposer;

said kneading temperature T1 is not lower than said pre-heating temperature T0 but is lower than the thermal decomposition temperature of the thermosetting resin;

said maximum temperature T2 is lower than the thermal decomposition temperature of the thermosetting resin; and

said pre-heating of the thermosetting resin is performed under the following conditions of temperature T0 and time t:

$$100^{\circ}\text{C} \leq T_0 < 260^{\circ}\text{C}$$

$$0.5 \text{ min} \leq t \leq 7 \text{ min.}$$

Regarding T0 and t, see, for example, Tables 1 and 2, at pages 26 and 27 of the specification, respectively, for Comparative Examples 1-3, compared to Example 1. In Comparative Example 1, preheating was carried out but no subsequent heating. In Comparative Examples 2 and 3, preheating was not carried out. Table 2 shows that Example 1 resulted in a higher percentage of decomposer consumed in a shorter treatment time, with a higher quality of decomposition (described in the specification at page 24, lines 3-13), compared to Comparative Examples 1-3. Additional comparative data appears in the specification. See the description regarding Comparative Examples 4-6, and Examples 2-33. In Comparative Example 4, there was no preheating; in Comparative Example 5, preheating

occurred but for too short a time. See Tables 8 and 9, at pages 33 and 34 of the specification, respectively.

The comparative results could not have been predicted by the applied prior art. The Examiner has not commented thereon.

New Claim 20, which is, in effect, the same as Claim 1 prior to the above amendment, is separately patentable, even if there was no difference between reclamation and decomposition, for reasons now discussed.

In Castle's method, cured polyurethane elastomers are first put into fine particulate form, such as by soaking the elastomer in a suitable solvent to swell the polyurethane at least to a semi-brittle state so that it can be very easily crumbled to fine particle size and then removing the solvent (paragraph bridging columns 2 and 3); milling the particulate cured polyurethane under shear sufficient to generate an elevated temperature, preferably at least about 120°F and to cause the particles to form a coherent mass (column 3, lines 25-28), which may be carried out relatively rapidly such as for about two minutes or so (column 3, lines 49-53); initiating devulcanization by adding a devulcanizing agent which is a suitable aliphatic alcohol, water, or mixture thereof to the cohesive mass (paragraph bridging columns 3 and 4), wherein the operating conditions increases the temperature during the devulcanizing step to between about 120°F and 280°F (column 4, lines 31-34). In Example 1 therein, the cohesive mass is subjected to a temperature of about 220°-270°F, while the mass is being mixed in a mixer under compression, whereby water is added to the mixture and mixing is continued for 15 minutes.

It is clear from Example 1 that water is present as a devulcanizing agent therein. Other devulcanizing agents are used in some of the other examples, although it is noted that contrary to the findings by the Examiner, butanediol used in Example III and triisopropylamine used in Example V, are used as curing agents, not devulcanizing agents.

Castle neither discloses nor suggests a pre-heating step, *per se*. In Castle, prior to carrying out devulcanizing, heating is carried out during the milling step, and optionally during the swelling step (column 3, lines 1-3). Castle neither discloses nor suggests the simple expedient of pre-heating, as recited herein, prior to kneading a pre-heated thermosetting resin together with a decomposer, and the superior results obtained thereby, as demonstrated in the specification and discussed in further detail below.

The Examiner has found that Castle “uses milling as a means of heating the polyurethane waste to a temperature high enough to obtain the cohesive force.” Thus, the Examiner, in effect, admits that Castle neither discloses nor suggests *only* pre-heating. Indeed, in Castle, the step analogous to the presently-recited pre-heating step of Claim 20 involves milling, i.e., a step wherein the polyurethane resin is changed by mechanical forces, beyond a change in temperature. Note that Applicants’ argument is not that Castle does not specifically disclose the term “pre-heating,” but rather that the step of Castle analogous to the presently-recited pre-heating step requires milling as well.

For all the above reasons, it is respectfully requested that the rejections over prior art be withdrawn.

The rejection of Claims 1-17 under 35 U.S.C. § 112, first paragraph, is respectfully traversed. It is assumed that this rejection now applies to new Claim 20. One skilled in the art would have understood that the previous term “only”, and the present term --during said preheating step, no other operation is performed on or with the thermosetting resin--, was inherently described. *See, e.g., Kennecott Corp. v. Kyocera Int'l, Inc.*, 835 F.2d 1419, 5 USPQ2d 1194 (Fed. Cir. 1987) (term “equiaxed microstructure” not literally disclosed held to be inherent property of claimed sintered ceramic body); *In re Wright*, 866 F.2d 422, 9 USPQ2d 1649 (Fed. Cir. 1989) (term “not permanently fixed thereto” not literally disclosed held to be described by absence of disclosure of permanently fixed microcapsules); and *In re*

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Voss, 557 F.2d 812, 194 USPQ 267 (CCPA 1977) (term “crystalline content . . . at least 50% by weight” not literally disclosed held to be described by literal disclosure of “glass-ceramic material” coupled with evidence that one skilled in the art would have attributed the recited crystalline content as inherent in that material).

The Examiner finds that term “only” is not inherently described, but offers no reasons in support.

For all the above reasons, it is respectfully requested that this rejection be withdrawn.

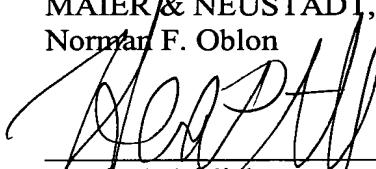
The objection to the specification is respectfully traversed. There is no requirement that claim limitations inherently described in a specification must be explicitly added thereto. Accordingly, it is respectfully requested that the objection be withdrawn.

Applicants respectfully submit that all of the presently pending and active claims in this application are in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

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